

start-up period of time, or when the proper exercise rhythm on the part of the user is sensed, the motor is disengaged or transitions to a free-wheeling mode and resistance unit 134 begins to apply a selected level of resistance to the striding motion of vertical linkage arms 28'. In lieu of resistance unit 134, motor 132 may be made operable in a generator mode to provide dynamic braking resistance to flywheel 130.

It will be recognized that the above described invention may be embodied in other specific forms without departing from the spirit or essential characteristics of the disclosure. Thus, it is understood that the invention is not to be limited by the foregoing illustrative details, but rather is to be defined by the appended claims.

What is claimed is:

1. An exercise machine comprising:
  - (a) a frame;
  - (b) a pair of laterally spaced apart foot pedals, each pedal coupled to the frame by a respective articulated linkage comprising a generally vertical first linkage pivotally coupled to the frame and a generally horizontal second linkage pivotally coupled to both the first linkage and the respective foot pedal;
  - (c) a crank assembly coupled to both of the first linkages such that the first linkages move with an alternating reciprocating action;
  - (d) motor means coupled to the articulated linkage of each foot pedal for regulating movement thereof.
2. The exercise machine of claim 1 wherein the second linkage comprises a first arm and a second arm, each independently pivotally coupled to the foot pedal and the first linkage.
3. The exercise machine of claim 2 wherein the first and second linkage arms are of unequal length.
4. The exercise machine of claim 3 wherein the pivotal couplings of the first and second linkage arms are such that the foot pedal is progressively inclined as the foot pedal travels from an upper, forward position to a lower, rearward position.
5. The exercise machine of claim 1 further comprising means for biasing the foot pedals to a starting position.
6. The exercise machine of claim 5 wherein the biasing means comprises a spring.
7. The exercise machine of claim 1 wherein said motor means is coupled to the crank assembly for driving the first linkages with an alternating reciprocating action.
8. The exercise machine of claim 7 wherein the means for regulating movement comprises a flywheel for regulating movement of the first linkages.
9. The exercise machine of claim 8 wherein the motor means is selectively coupled to the flywheel to drive the first linkages during only a portion of an exercise routine.

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10. An exercise device, comprising:

a frame having a base portion<sup>16</sup> adapted to be supported by a floor;

first and second reciprocating members, each reciprocating member having a first end and a second end;

a rotating member supported by said frame and defining an ~~an~~ pivot axis;

means for attaching said second ends of said first and second reciprocating members to said rotating member so that rotation of said rotating member results in rotation of said second ends of said first and second reciprocating members in a ~~generally~~ substantially circular path about said axis while a portion of each of said first and second reciprocating members distal said second end of each said first and second reciprocating member moves in a reciprocating pattern;

a first foot supporting linkage assembly pivotally connected to said first reciprocating member proximate said first end of said first reciprocating member; and

a second foot supporting linkage assembly pivotally connected to said second reciprocating member proximate said first end of said second reciprocating member,

wherein each foot of the user of the device is movable through a ~~generally~~ substantially elliptical path.

11. The exercise device of claim 10, wherein said means comprises:

a first element attached at one end to said rotating member proximate said ~~pivot~~ axis, and at its other end to said second end of said first reciprocating member; and

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a second element attached at one end to said rotating member proximate said (pivot) axis, and at its other end to said second end of said second reciprocating member.

12. The exercise device of claim 10, further comprising a flywheel rotatably mounted on said frame; and a means for connecting said flywheel to said rotating member so that rotation of said rotating member causes rotation of said flywheel.

Sub 13. An exercising device, comprising:  
a frame having a base portion adapted to be supported by a floor;

first and second reciprocating members, each reciprocating member having a first end and a second end;

a rotating member supported by said frame and defining a pivot axis;

means for attaching said second ends of said first and second reciprocating members to said rotating member so that rotation of said rotating member results in rotation of said second ends of said first and second reciprocating members in a  
(substantially, generally) circular path about said pivot axis while a portion of each of said first and second reciprocating members distal said second end of each said first and second reciprocating member moves in a reciprocating pattern;

first and second linkage assemblies, said first linkage assembly pivotally connected proximate one end to said first reciprocating member proximate said first end of said first reciprocating member, said second linkage assembly pivotally connected proximate one end to said second reciprocating member proximate said first end of said second reciprocating member,

16

each linkage assembly being pivotally attached at its other end to said frame distally from said crank,

wherein each foot of the user is movable through a substantially elliptical path.)

14. The exercise device of claim 13, wherein said means comprises:

a first element attached at one end to said rotating member proximate said ~~pivot~~ axis, and at its other end to said second end of said first reciprocating member; and

a second element attached at one end to said rotating member proximate said ~~pivot~~ axis, and at its other end to said second end of said second reciprocating member.

15. The exercise device of claim 13, further comprising a flywheel rotatably mounted on said frame; and a means for connecting said flywheel to said rotating member so that rotation of said rotating member causes rotation of said flywheel.

Sub C2 / 16. An exercise apparatus, comprising:

a frame designed to rest upon a floor surface;

a crank mounted on the frame and rotatable relative thereto about a crank axis;

a first rigid member having a first portion movably connected to the crank and rotatable together therewith about the crank axis, and a second portion movable in reciprocal fashion relative to the frame;

a second rigid member having a first portion movably connected to the crank and rotatable together therewith about the crank axis, and a second portion movable in reciprocal fashion relative to the frame;

a first foot supporting linkage assembly movably connected to the first rigid member; and

a second foot supporting linkage assembly movably connected to the second rigid member, wherein each foot of a person standing on the apparatus is movable through a generally elliptical path.

17. The exercise device of claim 16, wherein the frame supports at least one roller which carries the weight of a person standing on the apparatus.

18. The exercise device of claim 16, wherein the first rigid member has a distal end opposite the crank, and the first foot supporting linkage assembly is connected to the first rigid member proximate the distal end.

19. The exercise device of claim 16, wherein the first foot supporting linkage assembly includes a rocker link rotatably connected to the frame.

20. An exercise apparatus, comprising:  
a frame designed to rest upon a floor surface;  
a crank mounted on the frame and rotatable about a crank axis relative to the frame;

a left foot support and a right foot support, each said foot support supported by the frame and movable through a generally elliptical path of motion relative to the frame;

at least one left link movably interconnected between the crank and the left foot support, wherein the at least one left link includes a rigid member having a first portion which rotates together with the crank about the crank axis and having a second portion which moves in a reciprocating path;

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at least one right link movably interconnected between the crank and the right foot support, wherein the at least one right link includes a rigid member having a first portion which rotates together with the crank about the crank axis and having a second portion which moves in a reciprocating path; and

a resistance device operable to resist rotation of the crank.

21. The exercise device of claim 20, wherein the frame supports at least one roller which carries the weight of a person standing on the apparatus.

22. The exercise device of claim 20, wherein the right foot support is connected to the rigid member of the at least one right link, proximate the second portion thereof.

23. The exercise device of claim 20, wherein the at least one right link includes a rocker link rotatably interconnected between the frame and the right foot support.

24. An exercise apparatus, comprising:

a frame designed to rest upon a floor surface;

a crank mounted on the frame and rotatable about a crank axis relative to the frame;

a left foot support and a right foot support, each said foot support movable through a variable path of motion relative to the frame;

at least one left link movably interconnected between the crank and the left foot support, wherein the at least one left link includes a rigid member having a first portion which rotates together with the crank about the crank axis and having a second portion which moves in a reciprocating path;

at least one right link movably interconnected between the crank and the right foot support, wherein the at least one right link includes a rigid member having a first portion which rotates together with the crank about the crank axis and having a second portion which moves in a reciprocating path; and

a resistance device operable to resist rotation of the crank.

25. The exercise device of claim 24, wherein the at least one right link includes a rocker link rotatably interconnected between the frame, the right foot support.

26. An exercise apparatus, comprising:  
a frame designed to rest upon a floor surface;  
a crank mounted on the frame and rotatable about a crank axis relative to the frame;  
a first link movably connected to the frame;  
a second link movably connected to the first link;  
a foot support connected to the second link and movable through multiple paths of motion relative to the frame;  
a third link movably interconnected between the crank and one of the first link and the second link; and  
a resistance device operable to resist rotation of the crank.

27. The exercise device of claim 26, wherein the third link is movably connected to the first link, and rotation of the crank causes the first link to move in reciprocating fashion relative to the frame.

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28. An exercise apparatus, comprising:  
a frame designed to rest upon a floor surface;  
a first rigid member, connected to the frame, and  
movable in a first direction;  
a second rigid member, connected to the first rigid  
member, and movable in a second, generally orthogonal direction;  
a crank rotatably mounted on the frame and linked to  
one of the first rigid member and the second rigid member in such  
a manner that rotation of the crank moves said one of the first  
rigid member and the second rigid member in its respective  
direction;  
a foot support connected to the other of the first  
rigid member and the second rigid member; and  
a resistance device operable to resist rotation of the  
crank.

29. The exercise device of claim 28, wherein a third rigid  
member is interconnected between the crank and the first rigid  
member, so that rotation of the crank causes the first rigid  
member to move in reciprocating fashion relative to the frame.

30. The exercise device of claim 28, wherein <sup>each said</sup> the foot  
support is constrained to occupy a substantially constant  
orientation during exercise motion.

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